NUI Galway
OÉ Gaillimh

Winter Examinations 2019/ 2020

Exam Code(s)	4BCT1
Exam(s)	4 th Year Examination Computing Science and IT
Module Code(s)	CT421
Module(s)	Artificial Intelligence
Paper No.	1
Repeat Paper	No
External Examiner(s)	Professor Jacob Howe
Internal Examiner(s)	Professor Michael Madden *Dr. Conn Mulvihill *Dr. Finlay Smith

Instructions: Answer 2 questions from each section. All questions will be marked equally. Use a separate answer book for each section.

Duration	2 hours
No. of Pages	4
Discipline(s)	IT
Course Co-ordinator(s)	

Requirements: None

PTO

Section A

1.

a. What is the purpose of the fuzzification step in a Fuzzy Logic Controller (FLC)? Describe two different methods of fuzzification.
(10 marks)

b. What are the differences between the way Fuzzy rules and conventional (crisp) are applied. Is it possible to have a hybrid system with both kinds of rules in the same system?
(10 marks)

c. In relation to AI search, describe the differences between forward and backward chaining. What criteria are used to determine which approach is most suitable to a given situation.
(5 marks)

2.

a. You have used a Qualitative Representation to model some objects on a table, you have also used a Quantitative Representation to model the same objects. How would you need to change each representation to allow for the following changes:
    i. Adding a new block to the table.
    ii. Removing one of the blocks.
    iii. Moving one of the blocks.
    iv. Placing one of the existing blocks on top of another existing block.
    v. Replacing one block with another block.
(15 marks)

b. In Mycin type systems, if the Certainty Factor (CF) for a conclusion X was deduced by two different rules to be 0.9 and 0.3, what would be the combined CF? (Show your workings)
(7 marks)

c. What assumptions are made that allow the CFs in Mycin type systems to be valid?
(3 marks)

3.

a. AI searches differ from conventional searches of data structures (trees, graphs etc.).What advantages do AI searches have over conventional searches? What limitations or problems are there for AI searches that do not exist for conventional searches?
(10 marks)
b. What are the differences between GDE and its extension, GDE+ and Sherlock? How is efficiency effected?
(7 marks)
c. If GDE produces multiple candidates, describe 2 steps that GDE could take to try and reduce the number of candidates. What are the potential effects on the number of candidates?
(8 marks)

Section B

4.

a. What do you understand by a 'greedy searcher?' (7 marks)
b. Suppose that in some currency the coins available for change are 50, 10, 5 and 1, and that the least number of coins is preferred. Explain what a greedy searcher will do if the change required is 70, where a greedy searcher at each step selects the biggest denomination that will work. (9 marks)
c. Suppose that in some currency the coins available for change are 25, 15, and 1, and that the least number of coins is still preferred. Explain why a greedy searcher will not perform optimally if the change needed is 30, where once again a greedy searcher at each step selects the biggest denomination that will work. (9 marks)

5.

a. In the context of genetic algorithms, explain what is meant by the term 'chromosome' (5 marks)
b. A software bot (like Mitchell's Robby) is to be developed for collecting cans in a 10 by 10 two-dimensional array. A cell of this array can be empty, or contain a can. In terms of context, a bot can see the contents of the current cell, and the contents of one cell north, south, east and west. In terms of actions, a bot can: Move one cell north, south, east, west, move one step randomly (north, south, east, or west), pick up a can in the current cell, or do nothing. A reward should be given if the bot picks up a can in the current cell. However, a fine should be applied if the bot's action is to pick up a can and there is in fact no can in the cell. Discuss the development of a suitable genetic algorithm for this bot (12 marks)
c. Do genetic algorithms always find a solution? (8 marks)

6. "Systems like Siri and Alexa represent the current state of Artificial Intelligence (AI), from the perspective of personal assistants. Alphazero and similar systems represent the more specialised area of game-playing AI." Discuss this statement under the following three headings: Current state of AI-based assistants (7 marks), current state of game-playing AI (10 marks), future trends (8 marks).